THERMAL MICRO-VALVES FOR MICRO-INTEGRATED DEVICES

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FIELD OF THE INVENTION

[0002] The present invention relates to microfabrication of microscale devices and reactions in microscale devices, and in particular, movement of biological samples in microdroplets through microchannels to initiate biological reactions. More particularly, the present invention relates to phase change latched valves for micro-integrated devices.

BACKGROUND

[0003] Current bioassay technologies are adequate for the detailed analysis of samples that range in number from hundreds to thousands per year. Projects requiring on the order of millions of assays, however, are beyond the capabilities of today's laboratories because of the current inefficiencies in (*i*) liquid handling of reagent and DNA template solutions, (*ii*) measurement of solution volumes, (*iii*) mixing of reagent and template, (*iv*) controlled thermal reaction of the mixed solutions, (*v*) sample loading onto an electrophoresis gel, and (*vi*) DNA product detection on size-separating gels. What is needed is methodology that allows for a high-volume of biological reactions without these existing inefficiencies.

[0004] Microfabricated devices are finding application in a wide range of new areas. As the functions performed by a device increases the design becomes more complicated. It then becomes essential to realize complex fluidic manipulation on the microfabricated chip device. Central to this problem, is the need to develop a microfluidic valve which is not only simple to integrate but also has high reliability as failure of one valve would lead to the failure of the entire device. This is one of the main problems hindering the commercialization of microfluidic devices. A lot of work is being done in both academic institutions and industry to solve this problem. However, most of the valves consist of a movable diaphragm, have intricate principles of actuation and elaborate fabrication procedures. This makes them difficult to integrate into a microfabricated device and

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